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Colville National Forest Vision 2020 CFLRP Monitoring Report

Photo Credit: Monique Wynecoop, View of Chewelah Valley and Colville National Forest from Quartzite Mountain

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Summary

When the NEW Forest Vision 2020 CFLRP was proposed in 2011, the highest priority desired 10 year outcomes were to, “Increase ecosystem resistance and resilience to disturbance, restore old-growth structure and function, and reduce wildfire risk and management costs by: 1) thinning small trees, reducing fuel loads and ladder fuels; 2) increasing firebreaks through landscape heterogeneity; and 3) employing fire as a management tool, and 4) establish a low-fuels buffer on the north boundary of the Colville Indian Reservation.” (NEW Forest Vision 2020 Proposal)

The 16 monitoring questions for the North Eastern WA Vision 2020 Collaborative Forest Landscape Restoration Program (CFLRP) were developed and coordinated by a multi-party monitoring committee, which is composed of USFS employees and members of the Northeastern WA Forestry Coalition. This report is an overview of the monitoring questions, monitoring projects addressing those questions, key findings, and lessons learned.

Monitoring Questions

1. How much did fuel project investment defer wildfire costs?
2. Did we move departure of stand structure, understory and landscape pattern toward a more sustainable condition?
3. Did we alter tree species composition to more resilient stands?
4. What type of variable density prescription is suitable for the range of CNF's mixed conifer forest?
5. How does the project affect late old successional forest and winter range?
6. Do our treatments reduce risk for crown fire and for how long does the effect last?
7. Did we maintain or improve water quality, quantity, and watershed function?
8. What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?
9. How did our historic activities (timber harvest, firewood cutting) affect and how are our existing activities affecting snag numbers and distribution?
10. Does the management of nest buffers and post-fledging areas and timing of activity restrictions adequately protect goshawks and keep them from abandoning an area?
11. Are our management activities regenerating aspen and other hardwoods at levels that will maintain or spread the clones?
12. Do management activities affect big game use of an area, and is the condition and amount of edible vegetation adequate to maintain desired big game populations?
13. Did our restoration treatments provide source habitats for focal terrestrial species?
14. Post-Fire Treatment Monitoring
15. How does CFLRP affect Tri-County Economics
16. How are forest management practices such as thinning and prescribed burning affecting the cultural practices of local tribes and communities for generations to come?

Wildfire & Fuels

Monitoring Question (s) Addressed	Lead	Program	Type of Work	Measure of Success
1	Ben Curtis, Regional Fuels Specialist, ben.curtis@usda.gov	2019 Risk Index Pilot	Fire Modeling using FSim	This metric is part of a series of calculations designed to measure the impact of varying fire intensities on Highly Valued Resources and Assets (HVRA). Report Filed
1, 6	Morris Johnson	Post-Fire monitoring	Monitoring the effects of postfire management on dead woody fuel dynamics and stand structure in a severely burned mixed-conifer forest	Generalized randomized block design, with replication (3 blocks, 3 treatments, 24 replicates in each block/treatment combination), with a pre-and post-treatment measurement for each fuel type. Preliminary results report Filed
14	Monique Wynecoop, R6 Fire Ecologist for NE WA, monique.wynecoop@usda.com Chris Stalling, Rocky Mountain Research Station	Post-Fire Pre- and Post-Treatment Monitoring FFI Protocol	Pre- and Post-Treatment monitoring using FFI protocol	Pre-treatment FFI plots were put in the Walker, East Wedge, and Lone Deer, and Sanpoil project areas pre-treatment and some have been revisited post-treatment

	Christine.Stalling@usda.gov Eric Pfeifer, CNF Republic Silviculturist, eric.pfeifer@usda.gov Donald Radcliffe, donaldradcliffe91@gmail.com			Fuels Reduction Increase in Plant Diversity Post-Treatment Decreased Tree Mortality
14, 16	Monique Wynecoop, USDA FS R6 Fire Ecologist, monique.wynecoop@usda.gov Vernon Stearns, Spokane Tribal Fuels Program, VernS@SpokaneTribe.com Chasity Watt, Confederated Colville Tribes IRMP Coordinator, chasity.watt@colvilletribes.com chasity.watt@bia.gov	Pre- & Post- Fire Monitoring FFI Rapid Response Protocol Participatory GIS Program, Mapping Meanings	Fire Effects Monitoring Participatory GIS Tribal Interviews	Heat map and discussion has been used to improve collaboration. Incorporation of feedback into fuels treatment planning and adaptive management Feedback from partners on how it improved collaboration CCT Project Results Paper

Question 1. How much did fuel project investment defer wildfire costs?

Key Findings

- 2019 Risk Index Pilot- NEW Vision 2020 was one of five CFLR projects that piloted a proposed risk index project, which is the Sum of Expected Loss, to assess wildfire effects on the landscape. Calculations from the simulation data indicate overall improvement in the risk posed by wildfire to the HVRAs used in this study.

    - Subsequent analyses could use more locally specific data on fuels and HVRAs to refine the impact of treatment and fire on the risk calculations for the local CFLRP
    - Initial results show the proposed risk index for the Northeast Washington Forest Vision CFLRP decreased by 8.6 percent (-627 to -573), while simultaneously decreasing burn probability by 26 percent.
    - The likelihood of high flame-length fire decreased by 6.5 percent for 6-foot and greater flame lengths and 1.1 percent for 8-foot and greater flame lengths within the CFLRP boundary.
    - Decreases in large flame-length probabilities were much greater in treated areas (50.1 percent and 52.4 percent for 6 and 8-foot flame lengths, respectively).
- Johnson *et al.* monitoring- For three different salvage prescriptions, stand structural metrics (snag densities), dead woody fuel loadings, tree regeneration, and vegetation cover before and after post-fire logging were quantified 1 year after the 2015 Stickpin Wildfire on the Colville National Forest in northeastern Washington State, USA. This study provides empirical data on the effects of different post-fire management strategies that can inform environmental analyses for future post-fire management decisions and address social concerns associated with this often-controversial area.
    - Results show that treatments have been and will be effective in controlling fire behavior.
    - The 1-, 10-, and 100-hr fuels had a significant treatment and block*treatment effects.
    - The 1000-hr sound class did not have a significant treatment effect but did have a significant interaction.
    - All fuel loadings tended to increase post-treatment in logged areas, whereas loadings tended to marginally decrease or not change in the control (unlogged) areas
    - The FFE-FVS modeling projected CWD accumulation in the controls exceeded total accumulation in both treatments reaching a maximum loading up to 90.09 Mg ha-1. Future fuel loadings may affect reburn severity as our

simulated wildfire 20 years after harvesting caused significantly mortality (89%) to regenerating forest
    - Almost all blocks showed a decrease in seedling counts pre and post-logging, including the control plots
- Because treatments are not allowed in the designated wilderness and roadless areas, there will still be large fires as evidenced by 2015.

Summary

2015: A Record Setting Fire Season for the Colville National Forest and also an example of the effectiveness of the CFLRP fuels treatments

Midway through the life of the NEW Forest Vision 2020 CFLRP, 2015 was a memorable and remarkable fire season for all of us on the Colville NF. A low snowpack and dry winter set the stage. Fuel treatments proved highly effective in assisting fire managers and firefighters with wildfire control and there were many successes. Though it was challenging as well, due to very dry conditions and the high number of fires, some treatments were not fully complete and thus not as effective. Based on results, our fuel treatments and where they intersected subsequent wildfires, it will be important to continue moving forward with options where possible. Hand thinning, underburning and a variety of mechanical treatments all had positive impacts for fire suppression.

Approximately a week after a high profile 1,100 acre underburn within the CFLR area was cancelled due to drier than normal conditions, the first extended attack wildfire within the CFLRP started on May 7th, 2015 (Hungry Hill.). The Hungry Hill Fire was started from a helicopter crash in a stewardship logging area, and was the initial step towards treating one of our high profile areas within the CFLRP.

That early season wildfire set the tone for what our Forest was going to experience in the coming summer. Through June, July and the first part of August, wildfire activity was very high in the CFLR area. There were approximately 40 unplanned ignitions, a majority of which occurred within USFS jurisdiction. Several of the fires remained at less than an acre, though several burned between 5 to 10 acres (unusual for the area), and one larger fire occurred at the end of July (North Boulder 2.). There were numerous occasions when local firefighters exclaimed over the radio that they were thankful the fire occurred in a fuels

treatment because it aided suppression efforts. All of those instances were within a defined Wildland Urban Interface (WUI) area.

By mid-August fuels conditions peaked: live fuel moistures bottomed out and we reached the 97th percentile. Also at that time, lightning activity caused an explosion of wildfires across the PNW, Idaho and Western Montana. That is the time when the large fires started, that burned within our CFLR area (Stickpin, Graves Mountain, Renner and Northstar). Due high fire activity, resource availability to suppress these fires was scarce. The Graves, North Boulder 2, Renner, and Stickpin Fires all started within untreated areas. Particularly, the Graves, Renner and Northstar fires did not have fire management teams assigned for four days or more, and when teams were assigned they did not have many firefighting resources available to them. It is with those fires we had a higher number of fuel treatments that positively contributed to fire suppression efforts.

In Graves and Northstar, all fuel treatments were completed, with several having been completed 3-5 years prior to the fire starting. What was exceptional about those two fires was that during at least the first five days, there were primarily local firefighters and managers taking action, and at the time these fires were several thousand plus acres in size. These were large-scale events being addressed by initial attack resources, and they were having success. A large part of that success was due to past fuel treatments. In Graves, a nearly 2,000 acre underburn from five years previous moderated fire behavior significantly, and allowed a relatively small number of firefighters to complete burn operations to keep the fire from crossing a major state highway and from burning high voltage transmission lines. With Renner, the wildfire occurred in an active stewardship sale, and although several units had been harvested and had some fuel treatments completed, most of the units were in mid-treatment (recent logging slash not yet treated, hand and machine piles waiting to be burned). Additionally, most of the fire growth for Renner occurred during the passage of a strong, dry cold front, when it was not safe for firefighters to take any action. Accordingly, the treatment effectiveness was mixed. Fire managers still found many benefits from the Renner treatments: they effectively anchored in a prescribed fire unit burned three years previous and they burned out several portions of the perimeter using strategically placed treatments along road systems.

Another observed benefit of the CFLRP fuel treatments is their correlation with reduced severity and associated reduced Burned Area Emergency Response (BAER) expenses. The Stickpin Fire had the least number of fuel treatments within its perimeter (nearly 3,000 acres were planned for treatment in a stewardship contract that had yet to be awarded) and had the highest burn severity acres. Initial BAER cost estimates were nearly $4 million. BAER cost estimates combined for Northstar, Graves Mountain, and Renner totaled less than $200,000. Not all of the benefits described above can be attributed to fuel treatment activities, but these treatments had a significant positive effect on suppression activities. The Renner fire provides a good example of that effectiveness. Specialists noted that even when fuel treatments did not help control the fire, crowns were still intact and much of the duff and larger, down fuels had not been consumed.

Question 6: Do our treatments reduce risk for crown fire and for how long does the effect last?

Key Findings

- Measured stands from past sales. Effect lasts about 15-20 years.

Monitoring Question 14: Post-Fire Treatment Effectiveness Monitoring

Key Findings

- Wynecoop *et al.* Northstar Fire Plots
    - Understory vegetation diversity was greater one year after the North Star Fire in areas with and without prior broadcast burning and mechanical fuels treatments.
    - We observed significantly greater plant species richness within Treated and underburned (TB) plots than within the Treated-only (T) plots. In contrast, species richness was not significantly different for TB plots compared to the plots that only experienced wildfire (B).
    - We observed significantly higher understory plant species diversity within TB plots than within T plots and also within B plots than within TB plots, showing that in this instance, fire was the key to increasing plant species diversity

    - The percent canopy cover of two of the six culturally important plants (Fragaria spp. and Arnica cordifolia) significantly increased one growing season post wildfire within treated plots and one (Arctostaphylos uva-ursi) significantly decreased in the treated plots post wildfire.
    - All common edible and medicinal plants of significance to the area Tribes re-sprouted one season post-Wildfire. The variability in percent cover was lowest within the plots that saw wildfire.
- FFI Plots in Walker, East Wedge, Lone Deer, and Sanpoil-
    - Walker- Preliminary results show that 15 years post-treatment, there seems to be no significant difference in litter & Duff within the control plots, burn, thin, and thin + burn.
    - East Wedge- Burn-out operations were aided by some of the East Wedge units.
    - Sanpoil- The Eagle Rock Unit had areas with substantial amount of edible and medicinal species of importance to the area tribes. Plots were established within these areas to assess how these cultural species respond to thinning and fire. The expectation is that they will respond favorably, as long as the soil is not greatly disturbed by heavy equipment.

Summary

FireMon (FFI) plots were established, pre-treatment, in the Walker, East Wedge, and Lone Deer Projects. Initially, crew leads from the Rocky Mountain Research Station came to the Colville National Forest and helped the Republic Timber Crew with the FFI protocol. The subsequent large wildfires that occurred on the Colville National Forest delayed the projects and thus the post-treatment monitoring. This FY 2020, a WA DNR crew was able to help collect post-treatment data from 54 plots, which included Plot Description, Tree Data, Microplot Photoload and Fuels (5 subplots), Log Data, and Species Composition (5 subplots) form at each plot.

Some successes this year included increased opportunity for collaboration due to an increase in virtual capacity of our partners. Since all meetings were virtual, it increased the amount of people that could participate, as well as their availability. There were also some huge challenges, including the logistics of planning the field season data collection,

especially with the unpredictability of bringing on seasonal employees, the unpredictability of childcare availability and the fact that many employees also had school-age children at home, and the resulting shorter field season. Despite all of this, the amount of collaboration that happened virtually was impressive. The CFLRP was mentioned in an AFE Podcast Incorporating Traditional Knowledge into Fuels Treatments. The CFLRP was also mentioned in my key note address for the NW Climate Adaptation Science Center Climate Deep Dive. There is a huge interest amongst our Tribal and Non-tribal partners for increasing collaborative fire and fuels treatment monitoring and science delivery to the public.

Monitoring Question 16: How are forest management practices such as thinning and prescribed burning affecting the cultural practices of local tribes and communities for generations to come?

Key Findings from Wynecoop et al. 2019 and Spokane Tribe PGIS Study

- Assessed understory vegetation response to wildfire within areas with and without prior broadcast burning and mechanical thinning in units that were burned by the 2015 Northstar Fire.
- Assessed where USFS treatment areas and cultural values of our tribal collaborators overlap and how the USFS can better manage these treatment areas to promote the values of interest to the Colville Confederated Tribes and Spokane Tribe within the V2020 area. The CCT project was done in 2015, following the Northstar Fire burning a significant portion of the Colville Reservation. The Spokane Tribe project was done in 2017, after the Cayuse Mountain Fire burned a substantial portion of the Spokane Reservation.
- Our participatory GIS exercise was effective for getting public input. By bridging the gap between traditional knowledge (TK) and western science, we addressed a common challenge for managers and scientists.
- Results help us determine if we are using the appropriate techniques to address Tribal concerns & meeting desired outcomes.
- In both projects, Participatory GIS and Interview results showed a majority were in favor of prescribed fire and wildfire.

- Recommendations for both Tribes regarding mechanical thinning were about combining with fire to increase nutrient cycling and reduce fuel loading.
- For the Spokane Tribe, areas to treat with mechanical thinning and/or prescribed fire focused around community and Wildland Firefighter safety and cultural and recreation access.
- Recurring theme – importance of water

- The majority of comments made by Confederated Colville Tribal Participants were in favor of more fuels reduction treatments when the implications for culturally important plants and practices were considered. The percentages reported here reflect the proportion of all comments regarding the treatment category.
- For mechanical thinning, PGIS participants recommended that CNF do more treatments (39%, n = 12), remove slash in a more timely manner (6%, n = 2), combine mechanical thinning with fire (6%, n = 2), make fewer roads (10%, n = 10), select trees to remove based on ecological concerns rather than economic value (3%, n = 1), and natural fire is best (3%, n = 1). Many PGIS participants had no recommendation about mechanical thinning (23%, n = 7).
- For prescribed fire, PGIS participants recommended more such treatments (64%, n = 18), that CNF personnel allow more wildfires to burn (4%, n = 1), that treatments mimic natural variability (8%, n = 2), and avoid needless treatments (4%, n = 1). Some thought that the benefit of prescribed burning depends on timing (4%, n = 1) and some had no recommendation (11%, n = 3).
- For wildfire, PGIS participants recommended allowing wildfire to burn when safe (75%, n = 9), implementing more fuel treatments for wildfire to be successful (8%, n = 1), avoiding post-fire removal of timber and debris (8%, n = 1), and leaving burned areas alone (9%, n = 1).

- The maps produced from the Colville Tribe PGIS mapping exercise showed where respondents felt fuels treatments would be most beneficial for cultural plants and where they should not be applied (n = 37). The maps represented all responses from PGIS participants, with red being the greatest level of concern, measured as the count of respondents identifying the place, and yellow being of less concern. Areas on or close to the CCT border were high priority for fuel treatments for respondents. This is the area where treatments are currently being planned. Areas where

participants felt that fuels treatments should be avoided were congregated around the Canadian-US border, around mountain tops, watersheds, prayer sites, and other sensitive locations that could be damaged more by fire suppression tactics or fuel treatments than by wildfire alone.

Stand Structure and Departure

Monitoring Question (s) Addressed	Program	Type of Work	Measure of Success
2, 3, 4, 5	Paul Fischer and Derek Churchill, Derek.Churchill@dnr.wa.gov	Data were collected in 10-acre monitoring plots in Deer Jasper unit 89, referred to as Doghouse A (DHA) and Doghouse B (DHB). Data were collected for portions of 10-acre monitoring plots in Deer Jasper unit 75, referred to as ZigZog A (ZZA) and ZigZog B (ZZB).	Departure from Historical Reference Conditions (HRV) using data that includes number of retention trees per clump and average tree diameter within clumps.
2, 3, 4, 5		Baseline Reference plots, QuickMap plots, BACI Fire plots, Pre & Post Treat LiDAR	
2, 3, 4, 5		Pre & Post Treatment LiDAR, Landfire (change in FRCC)	

Question 2: Did we move the departure of stand structure, understory and landscape pattern toward a more sustainable condition?

Key Findings

- The results show an accurate count of retention trees per acre and an estimate of basal area. Clump size distributions allow comparisons to reference conditions. A table of reference condition clump distribution is at the end of this report.

- Measured for Reference conditions and then compared treatments to reference conditions.
- Treatment efforts are hitting density targets and shifting composition towards resilient species. Prescription targets are higher than reference in some cases.
- Megaclumps are outside range of conditions of baseline plots, counting on fire to break up mega clumps
- Prescribed Fire and wildfire expanded openings and reduced density, but severity and effects were varied.
- Functional effects of different forest overstory spatial patterns
- Snow retention
- Tree regeneration, growth, and mortality
- Non-tree vegetation
- Micro-climate: temperature and light

Question 3: Did we alter tree species composition to more resilient stands?

Key Findings

- Treatment efforts are hitting density targets and shifting composition towards resilient species. Prescription targets are higher than reference in some cases.
- Spacing based and some BA treatments can be more uniform than reference plots or at lower end.
- Missing medium and large clumps and large openings.
- Large skips are outside the range of conditions of reference plots.
- Have clear reasons for large skips
- Burn the large clumps
- Manage for smaller skips / large clumps, or thin through some skips
- Many prescription approaches can work: BA+ clumps, Species based DxD, ICO, etc

Question 4: What type of variable density prescription is suitable for the range of CNF's mixed conifer forest?

Key Findings

- Measured for reference conditions to get variable densities by biophysical type.

- Clump size distributions, open space distributions, and density must all be balanced with respect to current conditions and objectives
- How do you measure restoration success at multiple scales?
- Stand Scale – Stand measurements
- Watershed and larger – LiDar
- Use lidar to show how we match up with reference after treatment.
- Could do whole forest, but accuracy would be low.

Monitoring Question 5: How does the project affect late old successional forest and winter range?

Key Findings

- Will assess with LiDar

Monitoring Question 9: How did our historic activities (timber harvest, firewood cutting) affect and how are our existing activities affecting snag numbers and distribution?

Key Findings

- See Question 5

Water quality, quantity, and watershed function

Monitoring Question (s) Addressed	Program	Type of Work	Measure of Success
8	Eric Moser, USFS Enterprise Program Hydrologist	Monitor directly, runoff and sediment from native surfaced system roads on a small scale pilot study basis. The watershed chosen is Cabin Creek, a small 3rd order channel that is	Bedload Sediment Capture, WEPP Road Module 2019 Road Runoff Monitoring Report

		tributary to Boulder Creek.	
7	Anurag Srivastava *et al.* 2018	GRAIP Study	Water Quantity Measurements Publication

Question 7: Did we maintain or improve water quality, quantity, and watershed function?

Key Findings

- Srivastava et al. 2018
    - Water yield increased from 256.6 to 271.0 mm as treatment area increased from 0% to 15.5% of the area, indicating an overall increase in water yield of 5.6%.
    - Fuel management practices resulted in a decrease in plant transpiration (Ep) and an increase in soil evaporation (Es). Ep decreased from 474.4 to 443.7 mm (6.5% decrease) and Es increased from 73.1 to 89.5 mm (22.4% increase) as the area treated increased from 0% to 15.5%.
    - At the hillslope scale, surface runoff and subsurface lateral flow increased by 13.7% and 4.4%, respectively, over the range of treated area (table 9). As the treatment area increased, baseflow increased at the outlet. The base flow increased by 5.9% from 140.5 to 148.8 mm when 15.5% of the area was treated.
    - Watershed with an annual average precipitation of 800 mm, increased post-treatment water yield ranged from 258 to 271 mm, compared to pre-treatment, when the treatment area increased from 10% to 50% of the sediment generating hillslopes
- CNF GRAIP Study
    - This work is ongoing. Reference sites were placed in numerous streams throughout the project area.
    - GRAIP study results showed that we could not treat enough to affect quantity.

Question 8: What is the anticipated influence of roads and the road restoration on in-channel conditions and water quality and streamflow?

Key Findings

- The two opened roads produced the only bedload sediment captured during the project term. Site 2, a recently maintained and high traffic route, produced 30.81 pounds of mostly sands and silts. Site 3, a moderately traveled native surface road without maintenance during the project period, produced 1.82 pounds of sands and silt.
- Site 1 and 3 were unchanged during the project term.
- Site 4 was opened and bladed in the early summer of 2018, before the June visit, though it did not appear to have yet been used for timber hauling by November 2018.
- Site 2 had a heavy amount of traffic and logging activity.
- The still well water was clear in all instances, except when sediment was also present, indicating that a substantial proportion was direct precipitation or the runoff lacked the energy to carry much sediment, suspended or otherwise.
- Aside from the problematic operation of the tipping bucket itself, and the data loggers (both installed for the determination of suspended load) site integrity was surprisingly good, particularly the water bars. In all cases functionality continued throughout the monitoring period.
- Bedload sediment production correlated quite well with site condition—open versus closed, high versus low/moderate traffic. Material cost of the water bars, berms, silt fences, piping and still wells was about 10-15% of the total. With rain gauges installed locally, inferences made above about timing and volume of runoff versus precipitation could be replaced by more certain discussion.
- The web interface version of WEPP road module was run, with parameters from Site 2, and results are show below in figure 9. The result of 22.08 pounds of sediment leaving the road prism as a 12 month average matches up well with the site production of 30.81 pounds over a 29 month run. Given of course that the amount of suspended sediment was not measured.

Wildlife

Monitoring Question (s) Addressed	Program	Type of Work	Measure of Success
10	Kelsey Retich, 3 Rivers RD Wildlife Biologist, Colville National Forest, kelsey.retich@usda.gov Peter Singleton, Wildlife Biologist, peter.singleton@usda.gov	GPS Tracking of Goshawks	Presence/absence of goshawks from project areas during and post-treatment. Assessing effectiveness mitigation measures.
12, 13	Dan Thornton, Assistant Professor, Washington State University, 509-335-3713	Effects of Wildfire and Forest Restoration on Lynx, Deer, and Other Wildlife in Northeast Washington. Objective 1-estimate occupancy/habitat use of focal species inside and outside of stands treated for fuels reduction Objective 2-estimate how occupancy/habitat use of focal species varies according to disturbance history and other environmental correlates sampled at stand and landscape scales including human recreational activities	As of 2020, They completed two summers of sampling with cameras (more than 400 camera stations placed) that will enable them to address thegoals. They have finished organizing and identifying all camera images from the first summer, but are still processing data from the second summer. This work forms the basis of an MS thesis as WSU and has been submitted to a peer-reviewed journal (Ecosphere).

		Objective 3- determine locations of lynx presence on CNF, and snowshoe hare distribution and relative abundance Objective 4- map distributions of a suite of other mid-large sized mammals and birds detected during camera surveys at a variety of features, including within forested, open, and rocky environments through CNF.	
11, 12	Stephanie L. Berry *et al.*	Differences in dietary niche and foraging behavior of sympatric mule and white-tailed deer	Fenced off young aspen and noted response in comparison to control. Publication Report

Monitoring Question 10: Does the management of nest buffers and post-fledging areas and timing of activity restrictions adequately protect goshawks and keep them from abandoning an area?

Key Findings

- Ongoing tracking of the Goshawks with GPS units. Results and final report are pending.

Monitoring Question 11: Are our management activities regenerating aspen and other hardwoods at levels that will maintain or spread the clones?

Key Findings

- Results show that fencing off the aspen stands benefits regrowth of shoots and suckers that would otherwise be targeted by foraging ungulates.

Monitoring Question 12: Do management activities affect big game use of an area, and is the condition and amount of edible vegetation adequate to maintain desired big game populations?

Key Findings

- Berry *et al*. - White-tailed deer consumed a more diverse diet than mule deer, which supports the idea that white-tailed deer might seek or require a higher-quality diet. Overall, the diets of white-tailed deer in the study contained about 25% more plant species than those of mule deer.
- WSU objective 1-estimate occupancy/habitat use of focal species inside and outside of stands treated for fuels reduction.
    - 60 cameras were placed within paired treated and untreated sites. The photos were analyzed together for occupancy of mule and white-tailed deer. We found a limited effect of treatment on occupancy of either species.
    - Although we did not find a strong relationship between fuels reduction treatments and deer occupancy per se, we found that occupancy by both species increased with decreasing visual obstruction (horizontal cover) and occupancy of mule deer increased with decreasing tree canopy cover, both characteristics that are enhanced by fuel reductions.
- WSU objective 4- map distributions of a suite of other mid-large sized mammals and birds detected during camera surveys at a variety of features, including within forested, open, and rocky environments through CNF.
    - We detected a large number of different species (including at least 13 different mid-large mammals, large ground birds, and at least 20 songbirds) during the various camera-sampling methods employed in the summer of 2019. We have not yet combined data across all cameras to provide maps of species detections for both 2019 and 2020.

Monitoring Question 13: Did our restoration treatments provide source habitats for focal terrestrial species?

Key Findings

- WSU objective 1-estimate occupancy/habitat use of focal species inside and outside of stands treated for fuels reduction (See question 12 above for key findings for objective 1).
- WSU objective 2-estimate how occupancy/habitat use of focal species varies according to disturbance history and other environmental correlates sampled at stand and landscape scales including human recreational activities
    - Of over 300 cameras, we detected over 2000 images of deer; 40% of cameras detected mule deer, 56% detected white-tailed deer, and 21% detected both. Estimated occupancy of sites by mule deer was 0.48, and for white-tailed deer was 0.60.
    - Occupancy by mule deer declined with visual obstruction (horizontal cover) and tree canopy cover, and increased with slope and elevation.
    - Mule deer were more likely to occupy the eastern side of the Kettle Crest.
    - White-tailed deer occupancy declined with visual obstruction, distance to roads, slope, elevation, and ruggedness. They were more likely to occupy the west side of the Kettle Crest.
    - We did not find a significant effect of fuels reduction treatment on occupancy by either species.
    - Using two-species conditional occupancy models, we found no evidence for 1) competition between the two deer species (occupancy of one species was independent of occupancy of the other), 2) Spatial avoidance of species, nor 3) temporal avoidance of species.
- Progress of fire work
    - In 2019, we conducted camera sampling of 2015 wildfires within Colville National Forest. For each of the four 2015 wildfires, we placed cameras across a range of fire severity classes (unburned, low, medium, and high severity. In total, we placed 60 cameras on trails, and 60 cameras off-trail, in the different fire severity classes. Image data has been identified and

organized. We found marked differences between detection rates of mammals in different forest severity classes.
    - In 2020, we placed an additional 86 cameras across the burned areas (43 stations of paired on-trail/off-trail cameras). We are in the process of sorting the camera images from 2020. Once complete, we will combine data from the 2 years of sampling and develop occupancy models to examine the impact of fire severity on mammal communities.
- WSU objective 3- determine locations of lynx presence on CNF, and snowshoe hare distribution and relative abundance
    - In summer 2019, we placed cameras at high elevation sites, along major hiking trails of the Kettle Crest. These cameras served to both analyze how human recreation impacts wildlife detection and to monitor for Canada lynx presence. In total, we placed 120 camera sites for 45 day periods across a large portion of the Kettle Crest, including cameras placed on trails and at various distances from the trail.
    - No lynx were detected on any cameras placed in summer 2019, but one lynx was detected on the cameras placed in 2020. This lynx was located in the southwest corner of the forest, to the south of Highway 20 and a few miles NW of White Mountain
- WSU objective 4- map distributions of a suite of other mid-large sized mammals and birds detected during camera surveys at a variety of features, including within forested, open, and rocky environments through CNF (See question 12 above for key findings for objective 4).

15. Socio-Economics

Monitoring Question (s) Addressed	Program	Type of Work	Measure of Success
15	Charles McKetta, PhD. Natural Resources Economist By Dan Green, PhD. Regional Economist MaryAnn Green, MA Resource Sociologist forestecon@moscow.com	Economic Modeling 1. Check the accuracy of published economic data and recalibrate the jobs and income estimates as necessary 2. Provide up-to-date county economic profiles 3. Increase resolution of wood products sector job & income linkages 4. Estimate the economic contributions of Colville National Forest CFLRP activities and provide a reference base for socio-economic monitoring 5. Identify local economic development bottlenecks and opportunities.	BLS (Bureau of Labor Statistics) data CBP (County Business Patterns) EMSI (Economic Modeling Systems Inc)

Monitoring Question 15: How does CFLRP affect Tri-County Economics

Key Findings

- Stewardship contracts showed increase in local capture
- 100% of timber sold went to local mills
- Between FY12-15, CFLR accounted for between 31 and 58 percent of total restoration spending (average 46%) However, the share and value of dollars that stayed local declined
- Local contractors awarded fewer set-aside contracts, slightly more non set-aside contracts
- Recommendations for increasing local benefits
- Increase use of stewardship contracts
- Use agreements to meet local objectives
- Hold a Contractor / Purchaser Meeting / Training
- Conduct a workforce assessment